CONODONT STRATIGRAPHY OF THE LOWER LEXINGTON LIMESTONE IN THE COMINCO AMERICAN INC. CA-38 BOREHOLE, MASON CO., KY.

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Research and compilation by

Dennis G. Zlatkin

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Approved by : ....

Advisor
Department of Geology

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INTRODUCTION

Long, continuous sections through the Middle and Upper Ordovician strata of the Cincinnati Region (Fig. 1) are indeed scarce. In the eastern section of the Cincinnati Region, exposures are limited to formations younger than the Lexington Limestone. Because of this scarcity, every section available from this area must be carefully studied to provide maximum stratigraphic control. Such a section is well represented by a 1,193- foot, 2.5-inch diameter core drilled in Mason County, Kentucky (Fig. 1) by Cominco American Inc. Study of the lower 120 feet of the Lexington Limestone in this core stands as the basis for this report.

The problem here studied encompasses correlation of the lower 120 feet of the Lexington Limestone in the Cominco core with the Lexington Limestone represented in cores drilled elsewhere in the Cincinnati Region. Lithic identifications are based on comparisons of shale-percentage logs (Fig. 2) and correlations based on matching logs depicting vertical fluctuations in relative abundance of *Phragmodus undatus* (Fig. 3), which is found in great profusion throughout the Lexington Limestone.

During the spring of 1971, 1,680 conodont-elements were collected by the writer from the lower 120 feet of the Cominco American C-38 core. Samples of limestone, weighing 100 to 500 gm, were first collected at five-foot intervals and were dissolved in 15-percent acetic acid. The samples were then washed and screened through 100- mesh screens. The samples were further reduced by use of the magnetic separator (*Magnetic Separation of Conodonts* , Verne E. Dow, 1960, Journal of Paleontology, v. 34, No. 4). The conodonts were then picked from the residue and mounted on micropaleontological slides.

All of the conodont-elements picked from this lower Lexington section are amber in color. Most of the specimens are very well preserved. Some of the limestone samples yielded very few conodont-elements (0-14). This made correlation somewhat uncertain at a few stratigraphic levels.

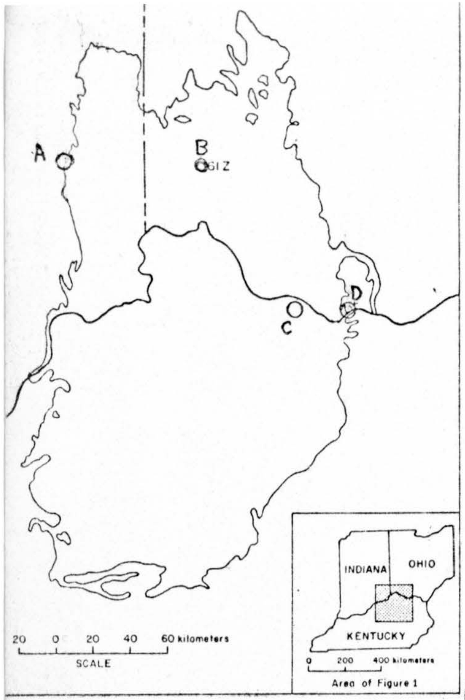
Data for the preparation of the shale-percentage log for the Cominco American CA-38 core was gathered in the following manner. The core was first subdivided into three-foot intervals. The individual shale and limestone beds were then measured and described. Only beds greater in thickness than .01 feet qualified as separate units. The percentage, by thickness, of shale in each three-foot interval was calculated, and finally each shale-percentage was plotted at three-foot intervals to scale.

Previous work on the Lexington Limestone has been conducted, in part, by the U.S. Geological Survey. The Lexington Limestone stratigraphic nomenclature has been rather recently revised by D.F.B. Black, E.R. Cressman, and W.C. MacQuown, Jr. One of their works, prepared in cooperation with the Kentucky Geological Survey, includes lithologic descriptions of the Lexington Limestone. The biostratigraphy of the Lexington Limestone has been well-treated by S.M. Bergström, of Lund University, Sweden, and W.C. Sweet, of The Ohio State University in some of their various publications involving their research with conodonts.

ACKNOWLEDGMENTS

The writer is indebted to Dr. Walter C. Sweet, of The Ohio State University, Department of Geology. The hours he devoted to supervision and proof-reading this report are greatly appreciated. Also, thanks is due to Howard E. Harper Jr. for measuring and describing the greater part of the lithology of the Cominco CA-38 core.

INDEX MAP



A- New Point borehole
B- Middletown borehole
C- CA-38 borehole
D- Manchester borehole

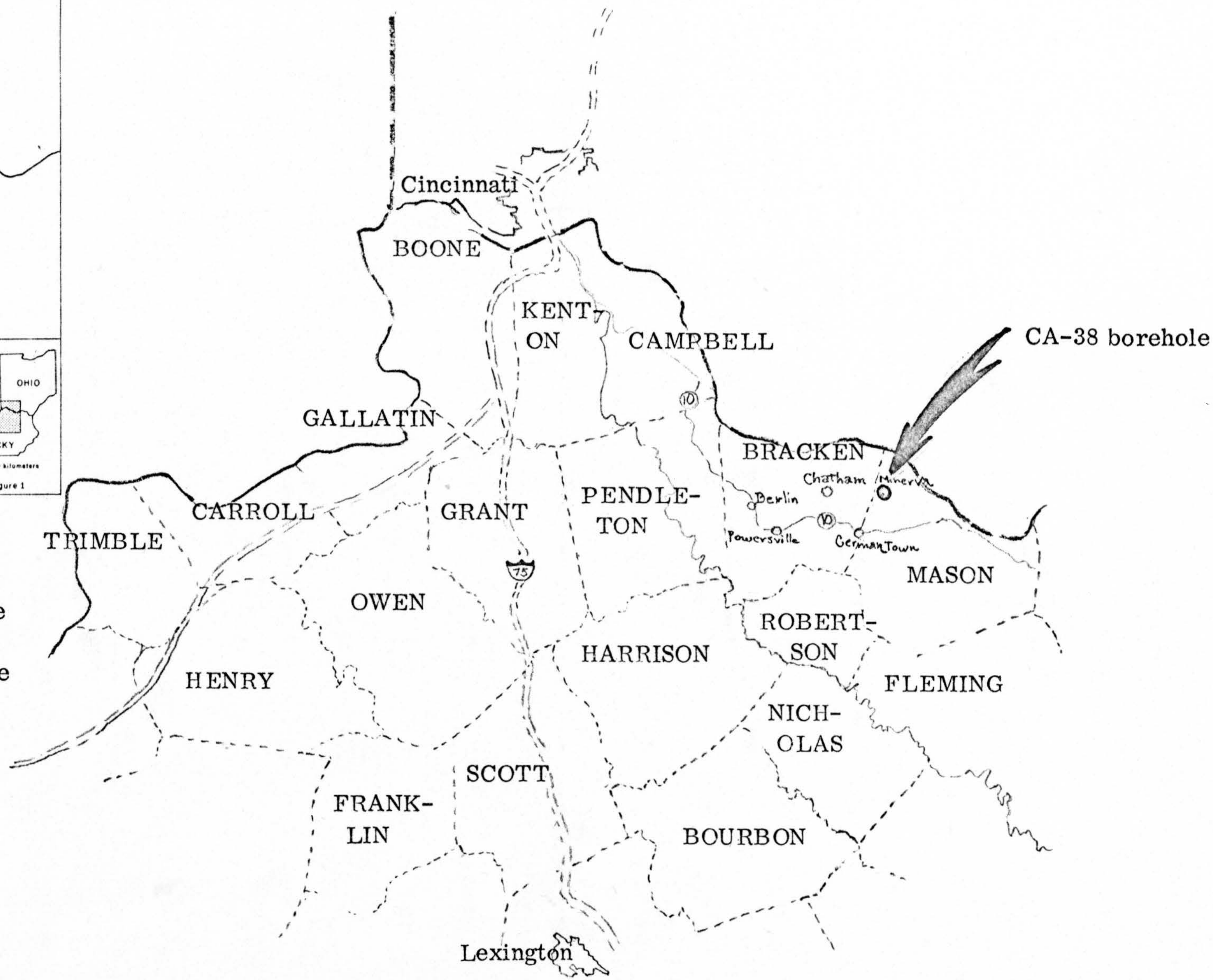


FIGURE 1

LITHOSTRATIGRAPHY OF THE LEXINGTON LIMESTONE

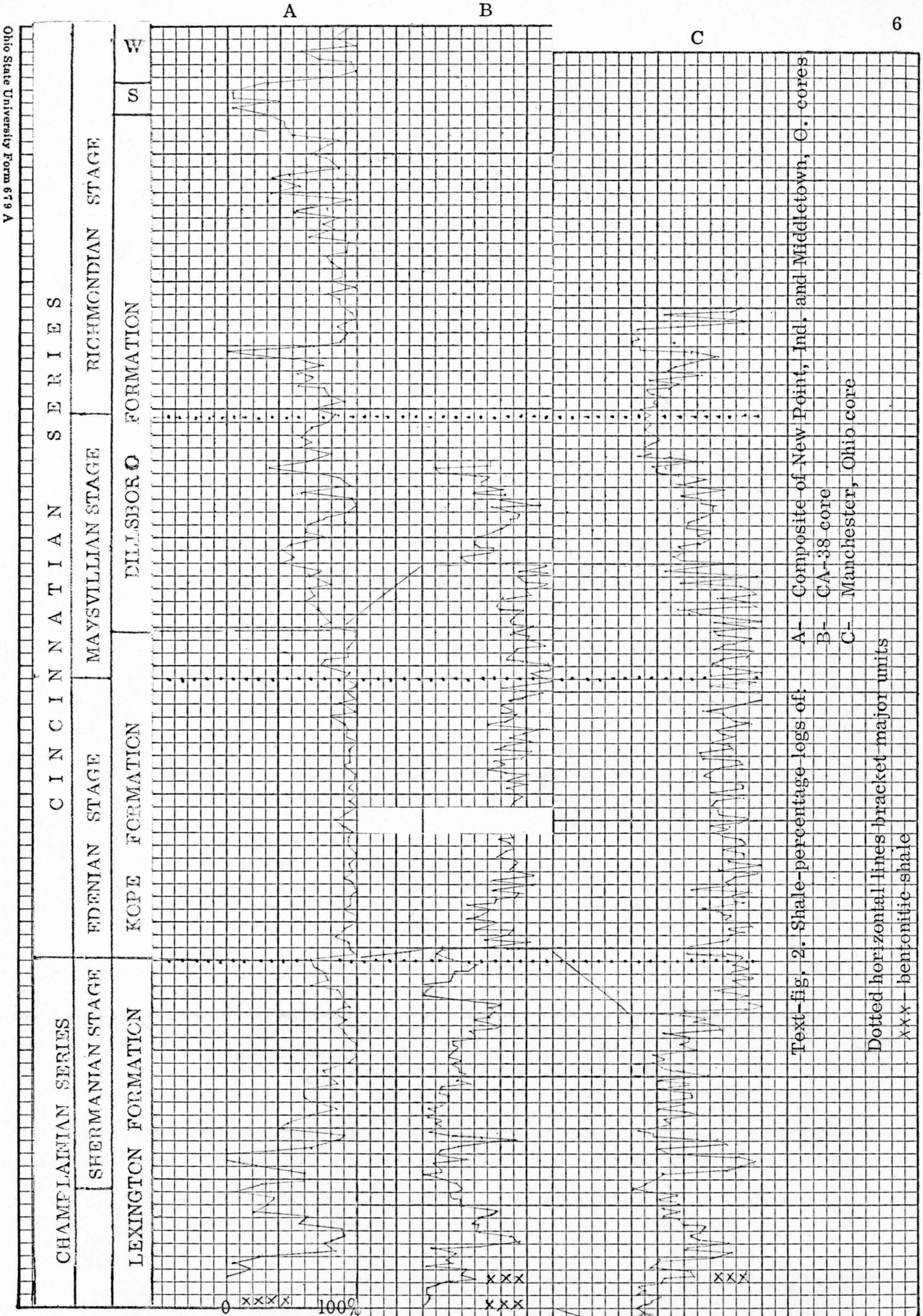
The Lexington Formation, as redefined by D.F.B. Black, E.R. Cressman, and W.C. MacQuown Jr., 1965, includes the Curdsville Limestone Member, the Logana Member, the Grier Limestone Member, the Brannon Member, the Tanglewood Limestone Member, the Devils Hollow Member, the Millersburg Member, and the Nicholas Limestone Member, in sequence from oldest to youngest. The Lexington Limestone is about 310 feet thick and includes the Middle Ordovician bioclastic carbonate rocks, bounded at the base by lithographic limestone of the Tyrone Limestone and overlain and partially laterally bounded by interbedded shale and tabular limestone which are included in the Clays Ferry Formation (Weir and Greene, 1965.) " Of these, the Curdsville, Tanglewood, and Nicholas Members are characterized by calcarenite consisting of subrounded bioclastic carbonate sand grains in large part well sorted and cemented with crystalline calcite and generally occurring in relatively planar surfaced beds. Crossbedding is common. The Logana and Brannon Members and the upper part of the Devils Hollow Member are composed mostly of very thin, tabular beds of micrograined, silty argillaceous limestone interbedded with gray shale. Most of the Grier Limestone Member is fossiliferous bioclastic limestone, commonly with cryptograined and micrograined matrix, that occurs generally in lumpy-surfaced beds with thin undulatory shale partings but also as rounded nodules surrounded by shale partings. The Millersburg Member is similar to the Grier in bedding character and limestone type but is much more shaly; the limestone is very fossiliferous and commonly occurs as nodules in a matrix of gray shale and in discontinuous beds with very irregular surfaces." (D.F.B. Black, E.R. Cressman, and W.C. MacQuown Jr., 1965)

Almost all the Lexington Limestone can be seen along both lanes of the Kentucky-U.S. Interstate Highway 64 east of the Kentucky River, in Frankfort East 7.5-minute quadrangle, Franklin County, Kentucky.

LITHOSTRATIGRAPHY OF THE LEXINGTON LIMESTONE IN BOREHOLE CA-38

The Lexington Limestone in the Cominco CA-38 borehole consists mainly of interbedded cryptograined to micrograined, light to medium grey limestone and dark grey to olive shale. Much of the limestone is very fossiliferous and contains abundant brachiopods, bryozoan and bivalve fragments, and crinoid columnals. Some small nodules of white to red chert approximately 1.0 cm in diameter appears here and there in the lower 20 feet of the core section sampled by the writer. Green-grey bentonitic shale occurs at at least two levels in the section described by the writer. These levels are shown by X's in Figure 2. The lower bentonitic shale marks the base of the Curdsville Member in the core. This bentonite level is underlain by the characteristic lithographic limestone of the Tyrone Formation. The upper contact of the Lexington Limestone is characterized by a marked increase in the abundance of shale, as illustrated in Figure 2.

It should be noted here that an error in sampling was encountered about 270 feet from the top of the Cominco CA-38 core. Ten feet of core was found in a box that was said on its label to contain only one foot of core. This caused considerable difficulties in identifying the CA-38 core with other cores depicted in Figure 2. In order to compensate for the error, the section of the shale-percentage log for the CA-38 core, above the point corresponding to 270 feet from the top of the core, was separated from the rest of the log and raised ten feet. This made the identification a little more reasonable.



Text-fig. 2. Shale-percentage logs of: A– Composite of New Point, Ind. and Middletown, O. cores
B– CA-38 core
C– Manchester, Ohio core

Dotted horizontal lines bracket major units
xxx– bentonitic shale

.10 inch = 10 feet

Figure 2

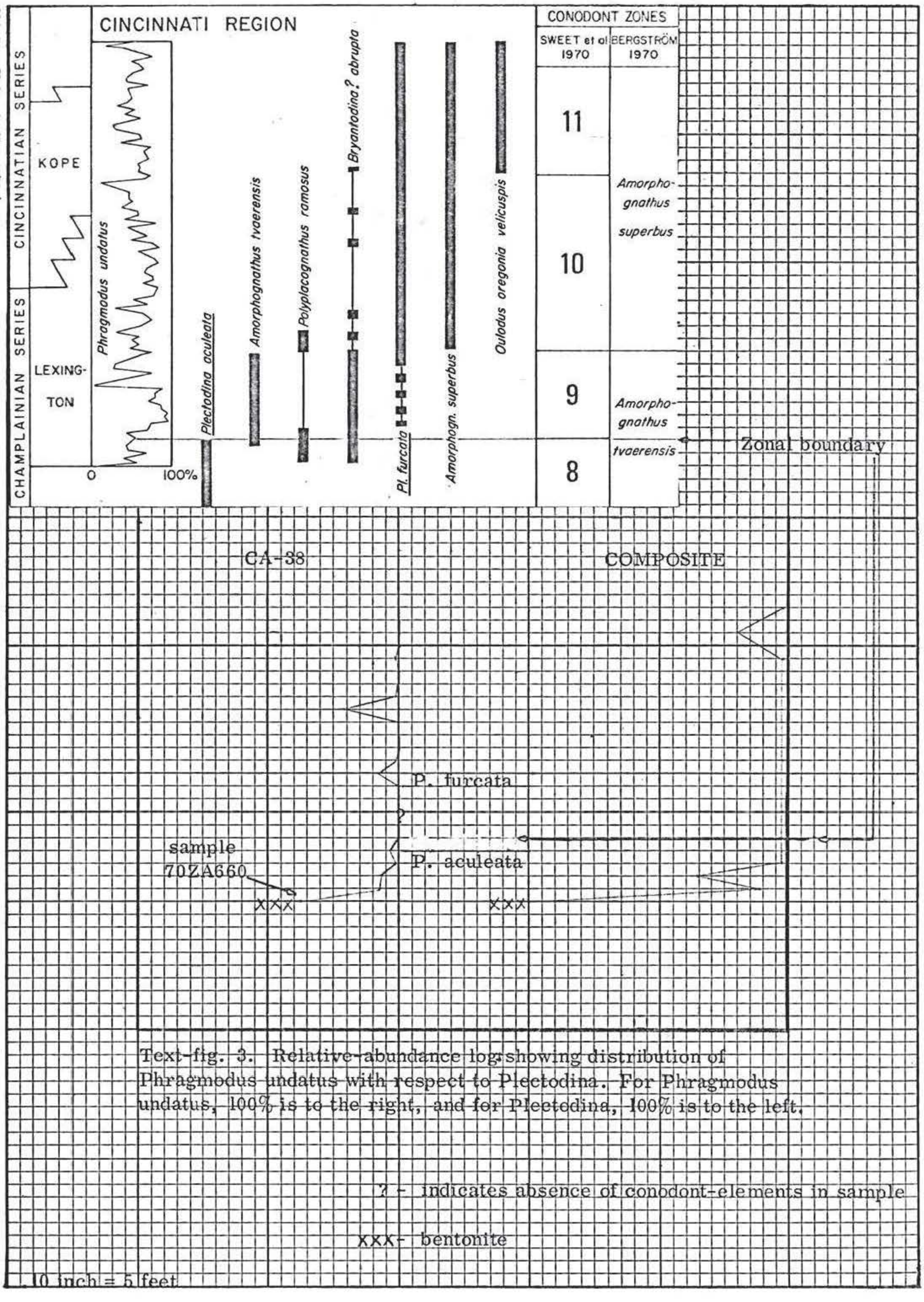
The 1,680 conodont-elements collected from the Lexington Limestone by the writer, can be distributed among 23 form-species. These represent 12 single and multielement species which are assignable to 11 genera. Two of the species, Icriodella superba (Rhodes) and Scolopodus insculptus (Branson and Mehl), are representatives of the "European fauna" (Sweet et al., 1959); the other conodont species are members of the "North American Midcontinent fauna" (Sweet et al., 1959). Sample-by-sample frequencies of the 12 conodont species identified are shown in Appendix A.

A relative-abundance log (Fig. 3) showing the distribution of Phragmodus undatus (Branson and Mehl) with respect to the genus Plectodina (Plectodina aculeata, Stauffer, and P. furcata, Hinde) was prepared for that portion of the core CA-38 studied. The number of specimens of these three species in each sample was first tabulated and summed. The sum was then divided into the number of specimens of Phragmodus undatus. The resultant figure was finally multiplied by 100. This final number represents the percentage of Phragmodus undatus in the collection of specimens of Phragmodus undatus, Plectodina aculeata, and Plectodina furcata in each sample. Figure 3 illustrates the resultant log and shows its correlation with one other.

Exposures of the lower part of the Lexington Limestone are not numerous; hence, the number of sections with which the lower Lexington Limestone of the CA-38 core may be compared is quite limited. A composite log that represents the relative abundance of Phragmodus undatus with respect to the genus Plectodina in cores drilled near New Point, Indiana and Middletown, Ohio, has been prepared by Seddon and Sweet (1971) for use in another connection. This log is also useful here and is shown, in part, in Figure 3. Also very useful in correlation was the zonal boundary between _Plectodina aculeata_ and _Plectodina furcata_, proposed by Sweet and others (1970). The illustration, by Sweet and others (1970) which shows this gradational boundary, is also shown in Figure 3. It is thought, by the writer, to be between 20 and 45 feet above the base of the section here studied. The zonal boundary proposed by Sweet and others (1970) falls within these limits. The relative-abundance logs shown in Figure 3. were correlated by matching the stratigraphically lower of the two bentonites in the CA-38 core with the one shown in the composite.

INDEX FOR APPENDIX A

SAMPLE NO.	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
70ZA 543	-	-	-	1	-	-	-	9	-	-	-	3	13
547	-	-	-	3	-	-	2	61	-	-	-	-	66
552	-	-	-	1	-	-	1	11	-	-	-	-	13
558	-	-	-	5	-	-	2	68	-	-	-	9	84
563	-	-	-	12	-	-	2	273	-	2	-	-	289
568	-	-	-	3	-	-	-	15	-	-	-	-	18
573	-	-	-	9	-	-	-	82	-	-	-	-	91
578	-	-	-	19	-	6	-	203	-	2	-	-	230
583	-	-	-	5	-	1	-	15	-	3	-	-	24
588	-	-	-	2	-	1	-	51	-	-	-	-	54
593	3	-	-	3	-	-	-	8	-	-	-	-	14
598	1	-	-	-	-	-	-	19	-	-	-	-	20
603	2	-	-	5	-	6	-	201	-	1	-	-	215
608	-	-	-	1	-	1	-	11	-	1	-	-	14
614	-	-	-	-	-	-	-	2	-	-	-	-	2
619	-	-	-	1	-	1	-	1	-	-	-	-	3
624	-	-	-	-	-	-	-	-	-	-	-	-	0
629	-	-	-	8	-	-	-	93	-	-	9	-	110
634	-	-	-	7	-	-	4	119	-	-	14	-	144
640	-	1	2	4	1	-	-	35	1	-	-	-	44
645	-	6	10	10	-	-	3	97	2	-	1	-	129
650	2	2	5	4	1	-	-	25	2	-	-	-	41
655	-	-	6	6	-	-	3	21	2	-	-	-	38
660	-	3	7	1	-	-	5	5	3	-	-	-	24
													1680



Text-fig. 3. Relative-abundance logs showing distribution of Phragmodus undatus with respect to Plectodina. For Phragmodus undatus, 100% is to the right, and for Plectodina, 100% is to the left.

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